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Clinical Effectiveness of the Plate Screw Internal Fixation Technique in the Treatment of Patients with Traumatic Fractures of Long Bones in the Lower Extremities

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Abstract: *Objective:* To investigate the effectiveness of the plate screw internal fixation technique on the clinical outcomes of patients with traumatic fractures of long bones in the lower extremities. *Methods:* From January 2022 to December 2023, 70 patients with traumatic fractures of long bones in the lower extremities were admitted to the hospital and randomly divided into two groups: the control group and the observation group, each consisting of 35 cases. The control group underwent traditional closed interlocking intramedullary nailing, while the observation group received internal fixation with steel plates and screws. Relevant surgical indicators, treatment effectiveness, and postoperative complication rates were compared between the two groups. *Results:* The observation group exhibited significantly short surgical duration (80.65 ± 5.01 vs. 88.36 ± 5.26 minutes), fracture healing time (13.27 ± 0.32 vs. 15.52 ± 0.48 weeks), and hospitalization days (10.49 ± 1.13 vs. 16.57 ± 1.15 days) compared to the control group (P = 0.000). The effective treatment rate was significantly higher in the observation group (29/82.86%) than in the control group (21/60.00%), with a significant difference observed (χ^2 = 4.480, P = 0.034). Additionally, the complication rate in the observation group (2/5.71%) was significantly lower than that in the control group (8/22.86%), with a correlated difference (χ^2 = 4.200, P = 0.040). *Conclusion:* The plate screw internal fixation technique demonstrates significant clinical efficacy in treating traumatic fractures of long bones in the lower extremities. It improves the healing rate, reduces complications, and represents a safe and effective treatment strategy worthy of widespread use and application.

Keywords: Plate screw internal fixation technique; Traumatic fractures; Long bones in the lower extremities; Effectiveness

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1. Introduction

As a commonly used surgical treatment method, the plate screw internal fixation technique is widely used in patients with traumatic fractures of long bones in the lower extremities. With the continuous progress of

medical technology, more studies focus on the clinical effectiveness of this technique and its impact on patient recovery. Traumatic fractures of long bones in the lower extremities are common clinical traumatic situations, which are mainly caused by traffic accidents, mechanical injuries, falling from height, and other factors [1], and its surgical treatment includes two types, namely, external fixation and internal fixation [2]. Due to the relatively low blood supply to the diseased part of the disease as compared to the rest of the organism, this makes fractures more likely to occur when suffering from trauma and causes the healing process to become slow. In this scenario, patients may experience a prolonged recovery period and a greater risk of complications. Therefore, adopting a scientifically-based surgical treatment program is crucial to promote patient recovery and facilitate the restoration of bone physiological function at the earliest opportunity [3,4]. As an internal fixation method, the plate screw internal fixation technique has the advantages of simple operation and good fixation effect and is widely used in fracture treatment. However, there are still some controversies and problems to be solved regarding its clinical application effect and long-term efficacy in traumatic fractures of the long bones in the lower extremities. Hence, this study was carried out to observe the clinical efficacy of 70 patients with traumatic fractures of long bones in the lower extremities to evaluate the therapeutic efficacy and safety of the plate screw internal fixation technique, and to provide more specific guidance for clinical practice.

2. Materials and methods

2.1. General information

A total of 70 patients with traumatic fractures of long bones in the lower extremities were admitted to the hospital between January 2022 and December 2023 and were randomly divided into the control group and the observation group, with 35 cases in each group. Inclusion criteria: (1) Aged between 18 and 65 years old; (2) Confirmed diagnosis of traumatic fractures of long bones in the lower extremities; (3) Willing to participate in the study and sign the informed consent form; (4) No serious cardiac, hepatic, renal, and other organ insufficiency. Exclusion criteria: (1) Pregnant or lactating female patients; (2) Patients with mental illness or cognitive disorders; (3) Patients who have previously undergone the same type of surgery; (5) Patients who are also suffering from other serious diseases that affect the treatment effect.

2.2. Methods

2.2.1. Control group

Traditional closed interlocking intramedullary nailing is adopted, with the following specific steps: (1) Preparation: Patients receive general anesthesia and the surgical site is sterilized to ensure a sterile environment. (2) Incision opening: Make an incision at the surgical site for insertion of intramedullary nails. (3) Insertion of intramedullary nails: The surgeon gradually inserts the intramedullary nails into the bone marrow cavity, passes through the fracture site, and fixes the fracture broken end. (4) Fixation of the fracture: By adding screws or other devices to the intramedullary nail, the fracture is held together to promote healing. (5) End of surgery: After confirming that the fixation status is good, suture the incision and perform wound dressing and care. (6) Rehabilitation: After the operation, it is necessary to closely observe the patient's recovery and carry out rehabilitation training and physical therapy to promote functional recovery.

2.2.2. Observation group

The technique of internal fixation with steel plate screws is adopted, with the specific steps as follows: (1) Surgical preparation: The patient receives general anesthesia and the surgical site is sterilized to ensure a sterile

environment. (2) Incision opening: Make an incision at the surgical site to expose the fracture's broken end and adjacent tissues. (3) Replacement and basic fixation: The fracture is repositioned to the correct position and basic fixation is performed to keep the position stable. (4) Election of appropriate plate: Select the appropriate size and shape of the plate according to the location and condition of the fracture. (5) Placement of plate: Place the selected plate into the fracture site and make sure that the plate fits the fracture site. (6) Fixation of the plate: Use screws or other fixation instruments to fix the plate to the fracture site. (7) Drilling and screw fixation: Pre-drill holes in the plate, then gradually place the screws into the fixed position and apply pressure to ensure that the fracture site is stabilized. (8) End of surgery: After completing the fixation, the surgical site is cleaned, the incision is sutured, and the wound is dressed and cared for. (9) Rehabilitation stage: Closely observe the recovery of patients after surgery, and carry out rehabilitation training and physical therapy to promote fracture healing and functional recovery.

2.3. Observation indicators

2.3.1. Surgery-related indexes

The surgery-related indexes of both groups were observed and compared. Surgery-related indexes include the duration of surgery, fracture healing time, and hospitalization time.

2.3.2. Surgical treatment effect

The Johner-Wruhs grading standard, a classification system used to assess the healing of closed fractures, is commonly used for long bone fractures of the lower limbs. The standard divides the fracture healing into four grades as follows: Grade I: No fracture gap, good healing; Grade II: Slight fracture gap, good healing; Grade III: Obvious fracture gap, poor healing; Grade IV: Complete discontinuity, instability, no sign of healing. The treatment effective rate is the sum of Grade I and Grade II cases among the total number of cases × 100%.

2.3.3. Complication rate

The complication occurrence of both groups was observed and recorded. Complication includes infection hypoproteinemia, poor wound healing, fracture displacement, and deformity healing.

2.4. Statistical analysis

SPSS 26.0 software was used for data analysis. Measurement data were expressed as mean ± standard deviation (SD), while the count data were expressed as [*n* (%)], and the comparison of the two groups was performed using two-sample mean *t* or chi-squared tests, with statistically significant differences indicated by *P* values of less than 0.05.

3. Results

3.1. Surgery-related indexes

Table 1 shows that the observation group has a significantly shorter surgery duration (80.65 ± 5.01 minutes), fracture healing time (13.27 ± 0.32 weeks), and hospitalization days (10.49 ± 1.13 days) as compared to the control group (88.36 ± 5.26 minutes; 15.52 ± 0.48 weeks; 16.57 ± 1.15 days; $P = 0.000$).

Table 1. Comparison of surgery-related indexes between the two groups of patients (mean ± SD)

Group	Surgery duration (min)	Fracture healing time (w)	Hospitalization days (d)
Control group (n = 35)	88.36 ± 5.26	15.52 ± 0.48	16.57 ± 1.15
Observation group (n = 35)	80.65 ± 5.01	13.27 ± 0.32	10.49 ± 1.13
t	6.279	23.074	22.301
P	0.000	0.000	0.000

3.2. Surgical treatment effect

As shown in **Table 2**, the effective treatment rate in the observation group (29/82.86%) was significantly higher than that in the control group (21/60.00%), and the difference was statistically significant (χ^2 = 4.480, P = 0.034).

Table 2. Comparison of the results of surgical treatment between the two groups of patients [n (%)]

Group	Grade I	Grade II	Grade III	Grade IV	Effective treatment rate (%)
Control group (n = 35)	6	15	10	4	21 (60.00%)
Observation group (n = 35)	14	15	5	1	29 (82.86%)
χ^2	-	-	-	-	4.480
P	-	-	-	-	0.034

3.3. Complication rate

Table 3 shows that the complication rate of the observation group (2/5.71%) was significantly lower than that of the control group (8/22.86%), and the difference was statistically significant (χ^2 = 4.200, P = 0.040).

Table 3. Comparison of complication rates between the two groups of patients [n (%)]

Group	Hypoproteinemia	Poor wound healing	Displacement fracture	Deformity healing	Occurrence rate (%)
Control group (n = 35)	1	4	2	1	8 (22.86%)
Observation group (n = 35)	0	0	1	1	2 (5.71%)
χ^2	-	-	-	-	4.200
P	-	-	-	-	0.040

4. Discussion

Traumatic fractures of long bones in the limbs are common situations that occur frequently in the clinic and require a long recovery period due to relatively slow blood circulation of the affected area, which seriously affects the daily life of the patients [5-7]. To accelerate the recovery process of patients, the current clinical treatment mainly adopts the technique of internal fixation with steel plate screws, which can effectively protect the fracture site and reduce the possibility of re-injury to the fracture, and at the same time, the use of steel plate with good toughness can withstand greater tension, thereby avoiding excessive load onto the fracture site, which plays a crucial role in promoting the recovery of patients [8-10]. The plate screw internal fixation technique is a widely used surgical method for treating traumatic fractures of the long bones in the lower extremities, and its basic principle is to provide stable fixation for the fracture site and promote fracture healing through the

combination of steel plates and screws. The technique is characterized by easy operation, reliable fixation, and wide adaptability, and is an indispensable part of modern orthopedic surgery. It is important to note that before performing internal fixation with plate screws, patients should be thoroughly evaluated, including age, health status, fracture type and site, and so on. Especially for the elderly or patients with underlying diseases, the risk of surgery must be carefully assessed to ensure the safety and feasibility of the procedure. Surgical procedures include anesthesia, position placement, surgical incision selection, fracture reduction, plate screw fixation, hemostasis, and suturing. Doctors need to strictly observe the principle of asepsis during operation to ensure safe and effective operation. Meanwhile, the postoperative rehabilitation program is also an important part of the treatment process, which should be formulated according to the patient's specific situation, including pain management, joint mobility training, muscle strength training, and so on. A scientific and effective rehabilitation program can help accelerate the recovery of patients and reduce the occurrence of complications. Despite the remarkable effect of plate screw internal fixation surgery, there are certain risks, such as infection, bleeding, thrombosis, screw loosening, or breakage. Therefore, doctors need to comprehensively assess patients' risk factors before surgery and take appropriate preventive measures.

This study shows that comparing the surgery-related indexes of the two groups, the length of surgery, fracture healing time, and hospitalization days of the observation group were significantly lower than those of the control group ($P = 0.000$). Comparing the effective treatment rates of the two groups, it was shown that the effective treatment rate in the observation group (82.86%) was significantly higher than that in the control group (60.00%; $\chi^2 = 4.480$, $P = 0.034$). Meanwhile, the complication rate of the observation group (5.71%) was significantly lower than that of the control group (22.86%; $\chi^2 = 4.200$, $P = 0.040$). The reasons for these observations are as follows: (1) The application of plate screw internal fixation, without the need for the fracture necrosis part of the fine washing treatment, can simplify the surgical process and shorten the length of the operation [11]; (2) after the implementation of plate screw internal fixation, the use of plate holes have the characteristics of tilted concavity, so that the fixation effect can be improved, and can also reduce the degree of local pain, thereby accelerating the speed of fracture healing [12]. In addition, some studies suggest that the application of plate screw internal fixation in limb fracture has significant effects in terms of metal fatigue resistance and mechanical strength [13,14].

In conclusion, the technique of internal fixation with steel plate screws has significant clinical effectiveness in treating traumatic fractures of the long bones in the lower extremities. The plate screw internal fixation technique can better maintain the position of the fracture end, reduce displacement and instability, and thus reduce the complications and adverse consequences in the treatment process. In addition, internal fixation provides earlier functional rehabilitation and return to activity, helping to shorten rehabilitation time and improve patient quality of life. This technique has become one of the most important surgical methods for treating traumatic fractures of long bones in the lower extremities and has been widely used and recognized. However, in practical application, it is necessary to individualize the treatment plan according to the specific conditions of patients. Meanwhile, strengthening the management of surgical safety, improving the postoperative rehabilitation program, and strengthening the long-term follow-up study are also key to improving the treatment effect.

Disclosure statement

The author declares no conflict of interest.

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